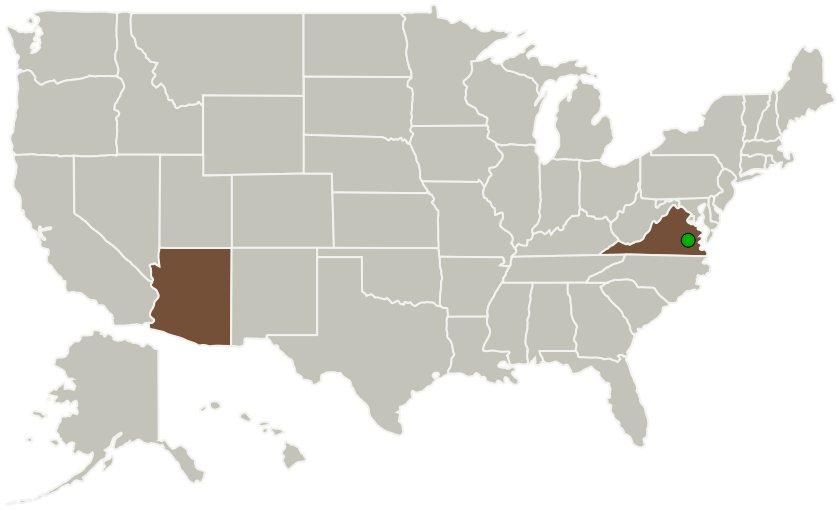
Enabling Technology for Thermal Protection on HIAD and Other Hypersonic Missions, Phase I

Completed Technology Project (2015 - 2015)

Project Introduction

S. D. Miller and Associates proposes to investigate a new class of thermal insulations that will enable thermal protection systems (TPS) on ceramic matrix composite (CMC) hot structures and Hypersonic Inflatable Aerodynamic Decelerators (HIAD). One insulation will embed silicon carbide aerogel in silicon carbide fibers to create a super-efficient, flexible insulation optimized for use at temperatures of 3500F and pressures >10 Torr. Another will demonstrate a lightweight, load bearing insulation that has borosilicate microballoons embedded in a borosilicate fiber matrix. The research team has prior experience developing a family of thermal insulations that have opacifiers embedded in a flexible fiber matrix. Testing has proven that these opacified fibrous insulations (OFI) are twice as efficient as unopacified insulations at temperatures >2000F and pressures <10 Torr. The proposed work will build on that proven concept by developing super-efficient, flexible insulations with aerogels, intumescents and microballoons embedded in silicon carbide, zirconia and silica fiber matrices. This will significantly reduce the weight of TPS on future NASA missions, reducing the cost of missions to Mars and other planets.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
S. D. Miller and Associates, PLLC	Lead Organization	Industry	Flagstaff, Arizona
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Arizona	Virginia

Project Transitions

June 2015: Project Start

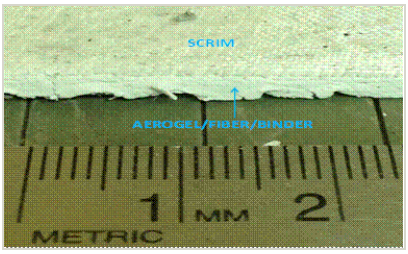
December 2015: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138838)*

Images

Briefing Chart
Enabling Technology for Thermal Protection on HIAD and Other Hypersonic Missions Briefing Chart *(https://techport.nasa.gov/image/134300)*



Final Summary Chart Image
Enabling Technology for Thermal Protection on HIAD and Other Hypersonic Missions, Phase I Project Image *(https://techport.nasa.gov/image/126786)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
S. D. Miller and Associates, PLLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

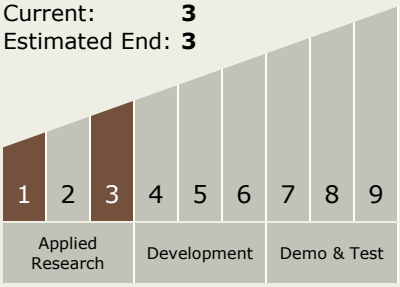
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Stephen Miller

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System